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SOVIET KT-12 TRACTOR ON A LENGTHENED CHASSIS

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[Tables and figures referred to herein are appended.]

Research Data

Research conducted by the Chair of Traction Machines of the Forestry Engineering Academy imeni S.M. Kirov shows that in skidding logs, the normal load can be raised as much as 1.3 cubic meters per ton of weight of the skidding tractor. The KT-12 skidding tractor weighs about 6 tons. Although it is supposed to be able to skid an average of 7.5 to 8 cubic meters of logs according to theoretical calculations, ordinarily the tractor skids a bundle of logs 4.5 cubic meters in volume.

It has been found difficult to increase the load hauled by the KT-12 skidding tractor above 4.5 cubic meters because of insufficient longitudinal stability of the machine. When gathering and hauling bundles of great volume, the tractor rears up (tips); in handling bundles greater than 4.5 cubic meters in volume, the tractor loses traction with the ground and skids, breaking the draw plate and burying the rear rollers in the ground.

The Forestry Engineering Academy imeni S.M. Kirov and TsNIIME (Central Scientific Research Institute for the Mechanization and Electrification of Logging), in cooperation with the Lenles (Leningrad Timber) Trust, carried out special research in 1950 to determine whether or not it was possible to increase the hauling capacity of the KT-12 tractor.

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In the laboratory tests, the researchers checked and located the coordinates of the center of gravity of a series-produced KT-12 tractor, and also tested the longitudinal stability of the tractor when it was subjected to tipping forces with the center of gravity in various positions.

The location of the geometric center of gravity, determined by a balance beam set up, is shown in Figure 1. The geometric center of the tractor is a point between the second and third support rollers and 1,685 millimeters from the driving sprocket gear axle.

To move the center of gravity forward, various sized counterweights were attached to the tractor's front bumper. The tests showed that the distance between the center of gravity and the geometric center was 55 millimeters in a series-produced KT-12 tractor. On a tractor with a counterweight of 150 kilograms, this distance increases to 90 millimeters, and with counterweights of 250, 354, and 404 kilograms, this distance increases to 128, 178, and 210 millimeters respectively.

Longitudinal stability of the tractor was checked by determining the tipping force required to make the tractor rear up, with varying locations of the center of gravity. For this purpose, counterweights of various sizes were again attached to the tractor's front bumper, and the magnitude of the force was measured by a dynamometer attached to the winch cable as shown by Figure 2. The magnitudes of the tipping forces necessary to make the tractor rear up were measured with various counterweights and without any counterweight, and with the shield in the working (lowered) position and in the transporting position. Results of these tests are given in Table 1.

From the table it is evident that to cause rearing up of the tractor with the shield in the transporting position, the tipping force must be 250 kilograms greater than when the shield is lowered. The high suspension [point] of the roller on the shield has a negative effect on the tractor's stability.

To increase the longitudinal stability of the tractor in picking up bundles of logs and to raise the tractive force on the winch cable to 5,500 kilograms (instead of 4,000 kilograms), it was necessary to move the center of gravity of the tractor 210 millimeters forward. Calculations showed that it would be necessary to move about 3 tons of metal 325 millimeters forward on the chassis to achieve this effect.

In remodeling the tractor at the central repair shops of the Lenles Trust, the following aggregates and parts, with a total weight of 3,010 kilograms, were moved forward: the winch and cable, the cab and seat, two storage batteries with cases, the control bridge and rods, the engine and gearbox, the exhaust pipe, the winch chain and the shield, engine fittings (carburetor, air filter, etc.), the surfaces for attaching the cab, winch, and hopper, the guide wheel assembly, the hopper with fuel and blowers, the fine filter without pipes, the cooling block with all gas pipes, the starting blower with tubes and firebox, the front end of the chassis and bumper, 35 tracks with pins, and the loading shield with toolbox. This shifting of parts and units made it necessary to lengthen the tractor chassis by 325 millimeters.

Remodeling of Tractor

Remodeling of the tractor was carried out in this sequence:

1. After removal of all mechanisms and parts, the surfaces where the cab, winch, and hopper were attached were cut off with an oxyacetylene torch. Next, the chassis channel bars between the guide-wheel axle-reinforc[illegible], tube and the front spring brackets were also cut with a torch.

2. Pieces of No 24 channel bar, 325 millimeters long, were welded to the chassis side members, after which the cutoff front section of the chassis was welded onto the lengthened side members. To increase the strength of the chassis, strips 500 x 240 x 10 millimeters were welded to the inside of the channel bars along their entire width, and No 7 angle iron sections 750 millimeters long were welded to the outside of the channel bars.

3. The propeller shaft and the control rods were cut and made 325 millimeters longer.

4. The tension devices for the guide wheels were made longer.

5. The small front balance beams were reversed, and the longer arms of the beams were put in front.

6. All the surfaces for attaching units were rewelded to the chassis without changing their position in relation to the front end of the chassis, and all the parts and units removed earlier were remounted.

7. A support bracket was welded to the winch to fill in a gap of 195 millimeters which was formed between the winch and shield supports of the chassis after the shield was moved forward 130 millimeters.

8. Six tracks with pins were added to both sides of the caterpillar band.

After assembly, the tractor was again given laboratory tests for longitudinal stability. The tests showed that the center of gravity of the modernized KT-12 tractor is 287 millimeters away from the geometric center of the series-produced tractor, or 1,972 millimeters from the driving-sprocket gear axle. The tipping force on the winch cable necessary to make the modernized tractor rear up equals: (a) 5,100 kilograms when the shield is in the working position (lowered); (b) 5,500 kilograms when the shield is in the transporting position (raised), that is, 1,500 kilograms more or 37.5 percent more than for the series-produced tractor.

Calculations show that the distribution of pressure under the rollers of the modernized machine is better than that of the series-produced machine. Therefore, the load on the tractor can be increased 40 to 50 percent without overloading the undercarriage. Table 2 shows the calculated pressures on the ground under the rollers of the series-produced and the modernized tractor.

Field testing of the modernized KT-12 tractor was conducted at the Lisinskiy Training and Experimental Forestry Management. During the breaking-in period (16 to 25 August 1950), the average load on trips was 4.64 cubic meters.

The tractor hauled logs with an average volume of 0.35 cubic meters felled in mixed stands, with birch and aspen predominating. Ground conditions in the cutting area were extremely bad, with many swampy sections and ditches. Moreover, almost daily rainfall made working conditions worse.

During the following 15 days, the tractor's average load on trips was 6.1 cubic meters, and loads were sometimes as large as 7.5 cubic meters. In skidding logs for distances of approximately 400 meters, the tractor's productivity was as high as 51 cubic meters per shift.

During the whole period of autumn tests (around 300 hours) the average load hauled by the tractor on trips was 5.1 cubic meters.

The modernized tractor showed good stability in skidding logs, and did not rear up. With a load of 7 cubic meters, the tractor made its way across swampy sections without bogging down, but the power of the ZIS-21 engine was sometimes inadequate under these conditions.

In field tests conducted in winter, the tractor transported bundles of logs 8 cubic meters or more in volume without losing longitudinal stability and without skidding.

In January 1951, the modernized tractor skidded 1,057.4 cubic meters of wood in 23 days. On some days, the tractor did not work a full shift because of various organizational and technical difficulties. Average indexes for 14 working days when the tractor worked a full shift were as follows: output per shift, 65.6 cubic meters (varying from 40 to 80-85 cubic meters); productivity per man-day, 21.9 cubic meters; 75.9 percent of the trips were made with loads 7 cubic meters or more in volume.

Speed of tractor unloaded (idling) was 4.6 kilometers per hour; speed when loaded was 1.6 kilometers per hour.

Conclusions

Lengthening the chassis of the KT-12 tractor by 325 millimeters considerably improved its operating qualities. When the tractor's tractive force was increased to 5,500 kilograms, the tractor did not rear up. The supporting surface of the caterpillars was increased by 12 percent, and the actual specific pressure on the ground was reduced.

The load per trip with logs having an average volume of 0.4 cubic meters under muddy, autumn conditions has been increased to 6 cubic meters or more; and the winter load has been increased to more than 7 cubic meters. For skidding loads greater than 6 cubic meters, the ZIS-21 engine now used on the tractor is plainly inadequate. If a more powerful engine were installed on the tractor with the lengthened frame, its productivity per shift could be increased considerably.

Russian editor's note: Skidding tractors with lengthened frames made by the Kirov Tractor Plant, on the basis of the experimental model made by the Forestry Engineering Academy imeni S.M. Kirov and the Lenles Trust, are now being tested. The tests have revealed a number of deficiencies caused by interchanging the small front balance beams. Lengthening of the tractor is feasible, although evidently it will necessitate several changes in the design of the undercarriage.

[Appended tables and figures follow:]

Table 1. Minimum Tipping Force on Winch, Depending on Size of Counterweight

Counterweight (in kg)	Tipping Force on Winch: Shield in Working Position (in kg)	Tipping Force on Winch: Shield in Transporting Position (in kg)
None	3,750	4,000
148	4,000	4,200
242	4,250	4,500
326	4,500	4,750
368	4,800	5,100

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Table 2. Pressure on Ground Under Rollers of KT-12 Tractor With Various Loads (Figure above the line is for the series-produced tractor, figure below the line is for the modernized tractor.)

Volume of Bundle of Logs (in cu m)	Load (in tons)	Pressure on Ground Under Rollers (in kg)			
		Roller I	Roller II	Roller III	Roller IV
Without Load (idling)	--	830 / 679	596 / 1,165	651 / 508	751 / 516
3.75	3	600 / 578	452 / 997	1,107 / 923	1,211 / 905
5.0	4	522 / 545	404 / 949	1,260 / 1,060	1,366 / 1,035
6.25	5	444 / 512	355 / 835	1,384 / 1,200	1,475 / 1,165
7.5	6	367 / 479	308 / 843	1,568 / 1,335	1,680 / 1,294

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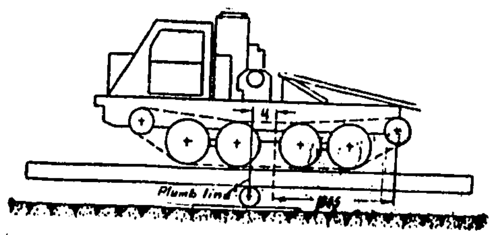

Figure 1. Determining the Geometric Center of Gravity of the KT-12 Tractor

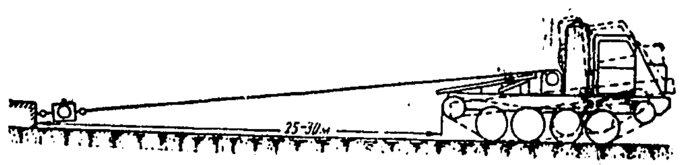

Figure 2. Dynamometer (D) Setup

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